MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

EME1016 – APPLIED STATICS
(ME)

23 OCTOBER 2017
09.00a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages with 4 Questions.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1 (25 marks)

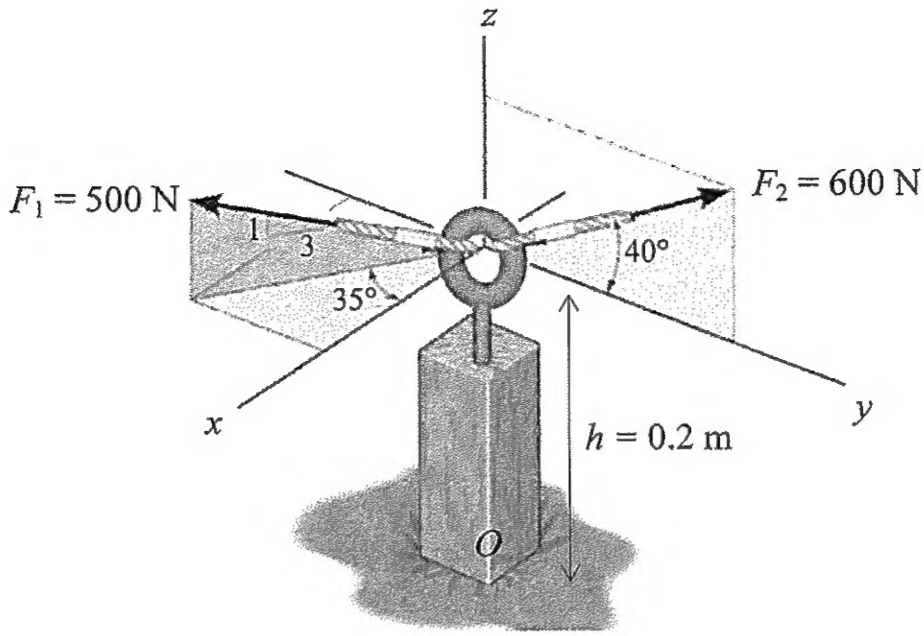

Figure 1

Figure 1 shows a wooden peg which has been driven into the ground. The peg has an eye-bolt ring. Two tight cables have been secured to the ring.

(a) Find the x, y and z components of F_1.
[4 marks]

(b) Find the x, y and z components of F_2.
[3 marks]

(c) Find the components of the resultant force on the ring.
[3 marks]

(d) Find the components of the bending moment which is acting on O. (Hint: use the answers for (c).)
[3 marks]

(e) The peg is to designed to bear a maximum horizontal load of N. Show that the horizontal component of the resultant force has not exceeded this design limit.
[4 marks]

(f) Explain the practical purpose of the peg and the cables.
[4 marks]

(g) Describe a situation in real life where this structure is useful.
[4 marks]

Continued ...

Question 2 (25 marks)

Figure 2 shows a truss which is used to support two loads. A is a hinge, whereas D is a rocker support (which does not provide a horizontal reaction).

(a) Find the vertical reaction of the support at A in terms of P.
[4 marks]

(b) Find the vertical reaction of the support at D in terms of P.
[4 marks]

(c) Find the internal force within the member AB in terms of P. State whether it is compressive or tensile.
[4 marks]

(d) Find the internal force within the member AE in terms of P. State whether it is compressive or tensile.
[4 marks]

(e) The member AB can bear a maximum force of 1750 N. The member AE can bear a maximum force of 1300 N.
Find the maximum magnitude of P, without going over either maximum.
[5 marks]

(f) Describe a situation in real life where such a truss would be useful.
[4 marks]

(*Hint*: Due to the different load forces on B and C, this structure does not have symmetrical loading.)

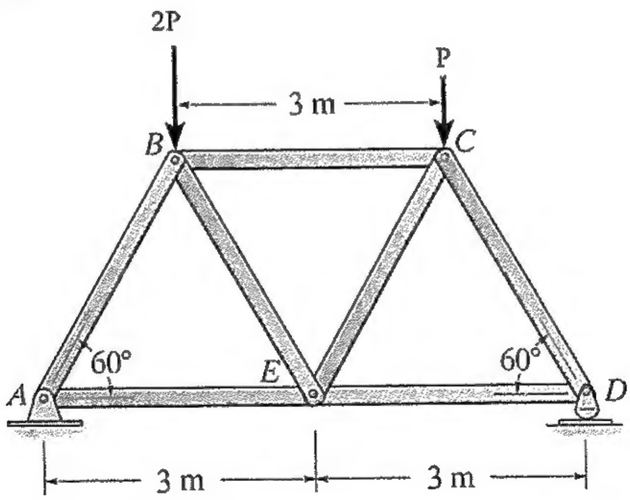

Figure 2

Continued ...

Question 3 (25 marks)

a) In Figure Q3 shows an extruded channel beam cross section with given dimension in millimeters (mm).

i. Tabulate the section into segmented components

[8 marks]

ii. Find the centroid $\bar{x}$ and $\bar{y}$ of the cross sectional area.

[4 marks]

b) Using the cross section in Figure Q3, Find mass moment of inertia for I_x and I_y.

[13 marks]

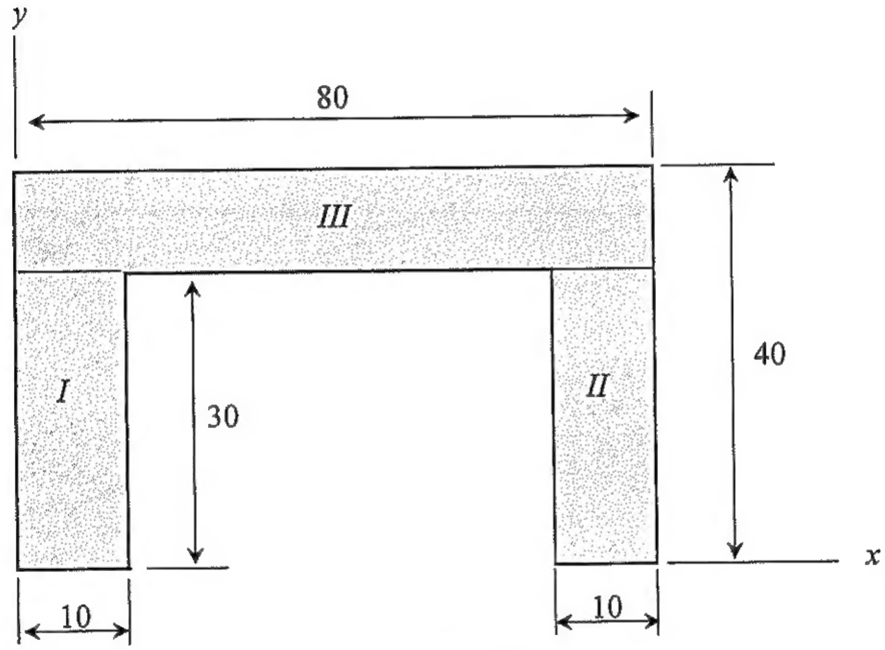

Figure Q3

Continued ...

Question 4 (25 marks)

a) In Figure 4(a) show an object *A* with weight, *W*, is about to slide down the ramp.

i) Draw the free body diagram for the system.

[4 marks]

ii) Find μ_s in term of gradient for the system shown

[6 marks]

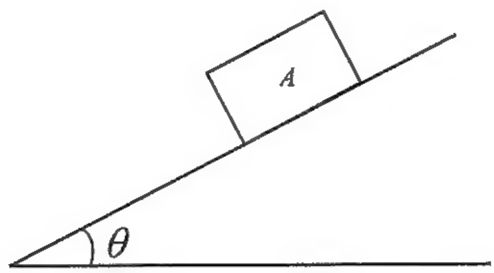

Figure 4(a)

b) A uniform weight 100N ladder is leaned against the smooth wall at point *A* shown in Figure 4(b). Given that the horizon force $F = 8\text{N}$, located at center gravity of the ladder, has cause the ladder to move to the left.

i) Draw the free body diagram of the ladder.

[3 marks]

ii) Find the static friction of coefficient, μ_s, between the ladder and the floor at point *B*

[12 marks]

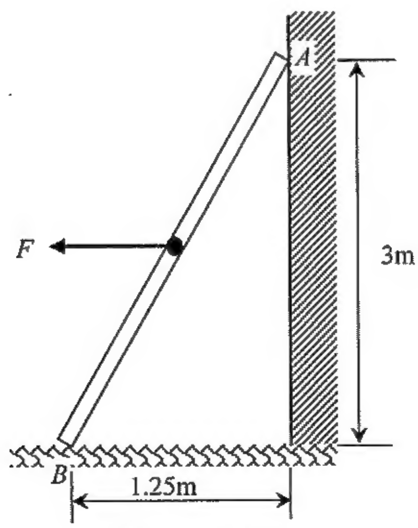

Figure 4(b)

Continued ...

Appendix: Equations

Equilibrium

Particle

$$\Sigma F_x = 0, \Sigma F_y = 0, \Sigma F_z = 0$$

Rigid Body-Two Dimensions

$$\Sigma F_x = 0, \Sigma F_y = 0, \Sigma M_O = 0$$

Rigid Body-Three Dimensions

$$\Sigma F_x = 0, \Sigma F_y = 0, \Sigma F_z = 0$$
$$\Sigma M_{x'} = 0, \Sigma M_{y'} = 0, \Sigma M_{z'} = 0$$

Friction

Static (maximum) $F_s = \mu_s N$

Kinetic $F_k = \mu_k N$

Center of Gravity

Particles or Discrete Parts

$$\bar{r} = \frac{\Sigma \tilde{r} W}{\Sigma W}$$

Body

$$\bar{r} = \frac{\int \tilde{r}\, dW}{\int dW}$$

Area and Mass Moments of Inertia

$$I = \int r^2\, dA \qquad I = \int r^2\, dm$$

Parallel-Axis Theorem

$$I = \bar{I} + Ad^2 \qquad I = \bar{I} + md^2$$

Radius of Gyration

$$k = \sqrt{\frac{I}{A}} \qquad k = \sqrt{\frac{I}{m}}$$

Tangent of a Pythagorean triangle with sides y and x $\tan\theta = \frac{y}{x}$

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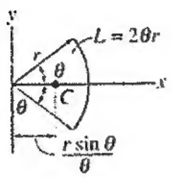
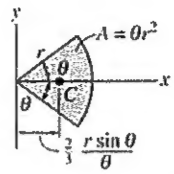
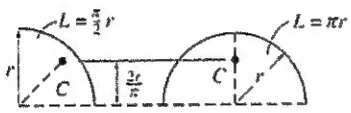
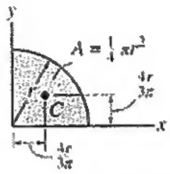
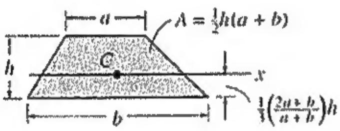
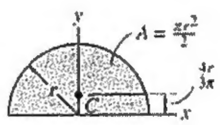
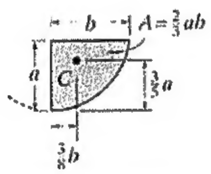
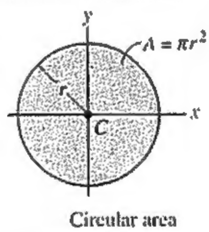
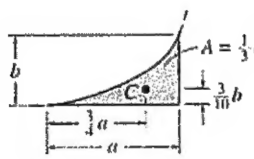
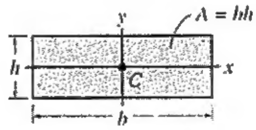
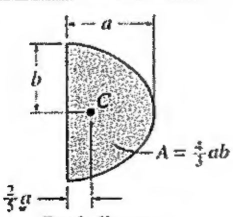
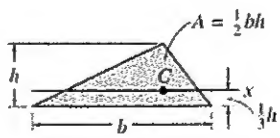
Appendix: Geometric properties of line and area elements

Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4} r^4(\theta - \frac{1}{2}\sin 2\theta)$ $I_y = \frac{1}{4} r^4(\theta + \frac{1}{2}\sin 2\theta)$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y = \frac{1}{16}\pi r^4$
 Trapezoidal area	 Semicircular area	$I_x = \frac{1}{8}\pi r^4$ $I_y = \frac{1}{8}\pi r^4$
 Semiparabolic area	 Circular area	$I_x = \frac{1}{4}\pi r^4$ $I_y = \frac{1}{4}\pi r^4$
 Exparabolic area	 Rectangular area	$I_x = \frac{1}{12} bh^3$ $I_y = \frac{1}{12} hb^3$
 Parabolic area	 Triangular area	$I_x = \frac{1}{36} bh^3$

End of Paper.